

DW03_bictr_scnto

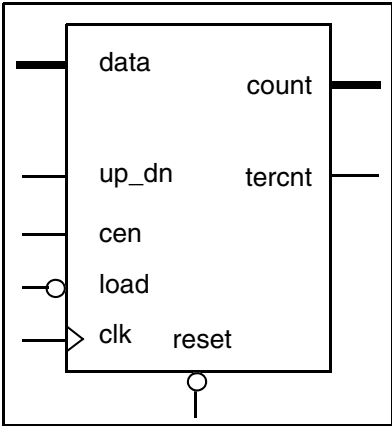
Up/Down Binary Counter with Static Count-to Flag

Version, STAR, and myDesignWare Subscriptions: [IP Directory](#)

Features and Benefits

- Parameterized word length
- Parameterized count-to value
- Up/down count control
- Asynchronous reset
- Loadable count register
- Terminal count flag
- Counter enable
- Includes a low-power implementation that has power benefits from minPower optimization (for details, see [Table 1-3](#) on page 2)

Revision History



Description

DW03_bictr_scnto is a general-purpose up/down counter with static count-to logic.

Table 1-1 Pin Description

Pin Name	Width	Direction	Function
data	<i>width</i>	Input	Counter load input
up_dn	1 bit	Input	High for count up and low for count down
load	1 bit	Input	Enable data load to counter, active low
cen	1 bit	Input	Count enable, active high
clk	1 bit	Input	Clock
reset	1 bit	Input	Counter reset, active low
count	<i>width</i>	Output	Output count bus
tercnt	1 bit	Output	Terminal count flag

Table 1-2 Parameter Description

Parameter	Values	Description
width	1 to 30	Width of data and count
count_to	1 to $2^{width-1}$	Count-to value

Table 1-3 Synthesis Implementations

Implementation Name	Function	License Feature Required
str	Synthesis model	DesignWare
lpwr ^{ab}	Low Power Synthesis model	<ul style="list-style-type: none"> DesignWare (P-2019.03 and later) DesignWare-LP (before P-2019.03)

- a. Requires that you enable minPower; for details, see [“Enabling minPower”](#) on page 5.
When minPower is enabled, the lpwr implementation is always chosen during synthesis.
- b. Effectiveness of low power design depends on the use of the `-gate_clock` option to `compile_ultra` command

Table 1-4 Simulation Models

Model	Function
DW03.DW03_BICTR_SCNTO_CFG_SIM	Design unit name for VHDL simulation
dw/dw03/src/DW03_bictr_scnto_sim.vhd	VHDL simulation model source code
dw/sim_ver/DW03_bictr_scnto.v	Verilog simulation model source code

Table 1-5 Counter Operation Truth Table

reset	load	cen	up_dn	Operation
0	X	X	X	Reset
1	0	X	X	Load
1	1	0	X	Standby
1	1	1	0	Count down
1	1	1	1	Count up

When the count value equals `count_to`, the signal `tercnt` (terminal count) is asserted (high). The signal `tercnt` can be connected to `load` through an inversion to synchronously reset the counter to a predefined value on the data in bus, `data`.

The counter is *width* bits wide and has 2^{width} states from “000...0” to “111...1”. The counter is clocked on the positive edge of `clk`.

The `reset`, active low, provides for an asynchronous reset of the counter to “000...0”. If the `reset` pin is connected to ‘1’, the reset logic is not synthesized, resulting in a smaller and faster counter.

The `count_to` is a parameter that ranges from 1 to $2^{width} - 1$. When the counter output, `count`, equals `count_to`, `tercnt` goes high for one clock cycle.

The `up_dn` input controls whether the counter counts up (`up_dn` high) or down (`up_dn` low), starting on the next positive edge of `clk`.

The counter is loaded with data by applying data to `data` and asserting `load` (low). The data load operation is synchronous with respect to the positive edge of `clk`.

When the count enable pin, `cen`, is high, the counter is active. When `cen` is low, the counter is disabled and `count` remains at the same value.

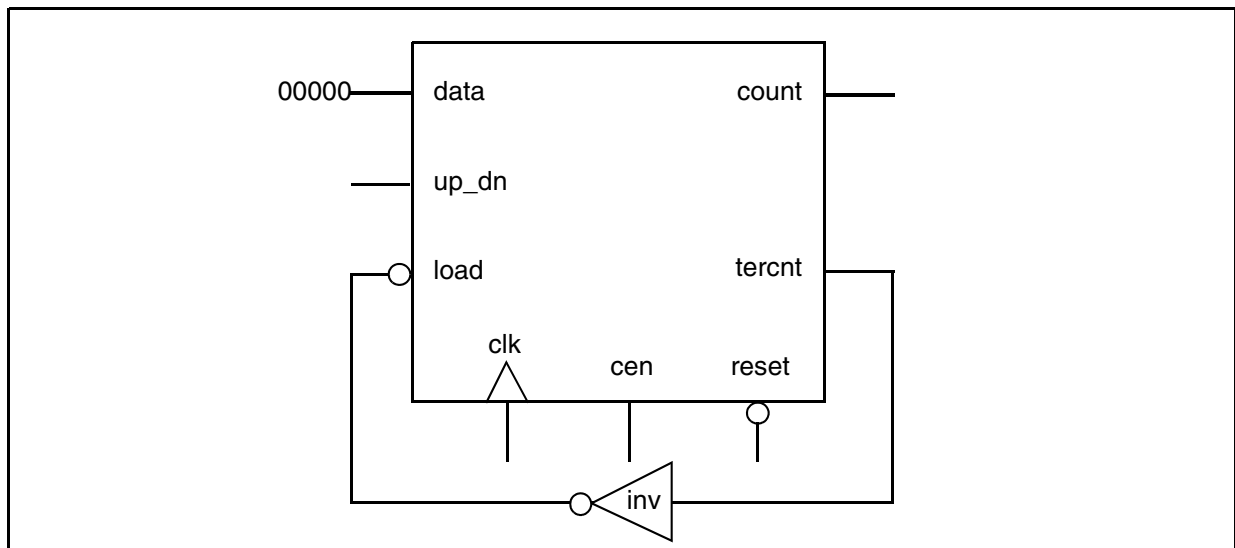
Application Example

An example application of DW03_bictr_scnto is to count from 0 to 17, repeatedly. This is done by:

1. Connecting the terminal count output signal, `tercnt`, to the load input.
2. Setting the data input to the start of the count sequence (for example, “00000”).
3. Setting the `count_to` parameter to the end of the count sequence (for example, 17).

The `count` output then cycles through the states 00000 (`data`) to 10001 (`count_to`); see [Figure 1-1](#).

Figure 1-1 Counter Application: “count_to”



Timing Diagrams

Figure 1-2 and Figure 1-3 show various timing diagrams for DW03_bictr_scnto.

Figure 1-2 Functional Operation: Count Up with tercnt = 7

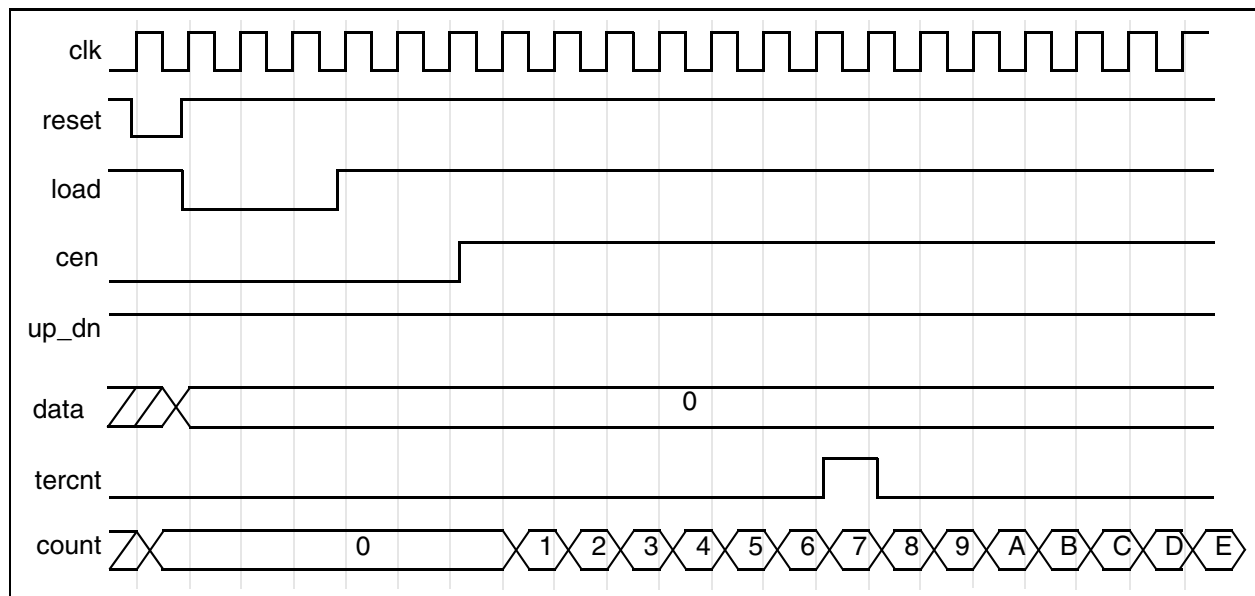
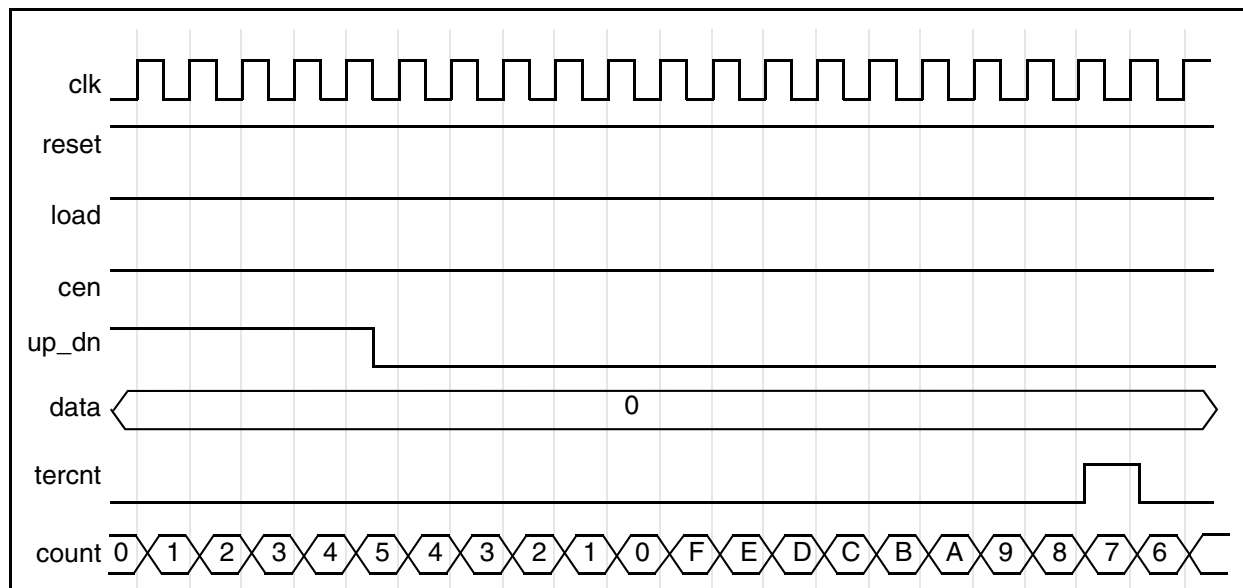


Figure 1-3 Functional Operation: Count Up with tercnt = 7



Enabling minPower

You can instantiate this component without enabling minPower, but to achieve power savings from the low-power implementation “lpwr” (see [Table 1-3](#) on page 2), you must enable minPower optimization, as follows:

- Design Compiler

- Version P-2019.03 and later:

- ```
set power_enable_minpower true
```

- Before version P-2019.03 (requires the DesignWare-LP license feature):

- ```
set synthetic_library {dw_foundation.sldb dw_minpower.sldb}  
set link_library {* $target_library $synthetic_library}
```

- Fusion Compiler

Optimization for minPower is enabled as part of the total_power metric setting. To enable the total_power metric, use the following:

```
set_qor_strategy -stage synthesis -metric total_power
```

Related Topics

- [Logic – Sequential Overview](#)
- [DesignWare Building Block IP User Guide](#)

HDL Usage Through Component Instantiation - VHDL

```
library IEEE,DWARE;
use IEEE.std_logic_1164.all;
use DWARE.DWpackages.all;
use DWARE.DW_foundation_comp.all;

entity DW03_bictr_scnto_inst is
  generic (inst_width      : POSITIVE := 8;
           inst_count_to : POSITIVE := 8);
  port (inst_data      : in std_logic_vector(inst_width-1 downto 0);
        inst_up_dn    : in std_logic;
        inst_load      : in std_logic;
        inst_cen       : in std_logic;
        inst_clk       : in std_logic;
        inst_reset     : in std_logic;
        count_inst     : out std_logic_vector(inst_width-1 downto 0);
        tercnt_inst    : out std_logic);
end DW03_bictr_scnto_inst;

architecture inst of DW03_bictr_scnto_inst is
begin

  -- Instance of DW03_bictr_scnto
  U1 : DW03_bictr_scnto
    generic map ( width => inst_width, count_to => inst_count_to )
    port map ( data => inst_data, up_dn => inst_up_dn, load => inst_load,
              cen => inst_cen, clk => inst_clk, reset => inst_reset,
              count => count_inst, tercnt => tercnt_inst );
end inst;

-- pragma translate_off
configuration DW03_bictr_scnto_inst_cfg_inst of DW03_bictr_scnto_inst is
  for inst
    end for; -- inst
end DW03_bictr_scnto_inst_cfg_inst;
-- pragma translate_on
```

HDL Usage Through Component Instantiation - Verilog

```
module DW03_bictr_scnto_inst( inst_data, inst_up_dn, inst_load,
                             inst_cen, inst_clk, inst_reset,
                             count_inst, tercnt_inst );

    parameter width = 8;
    parameter count_to = 8;

    input [width-1 : 0] inst_data;
    input inst_up_dn;
    input inst_load;
    input inst_cen;
    input inst_clk;
    input inst_reset;
    output [width-1 : 0] count_inst;
    output tercnt_inst;

    // Instance of DW03_bictr_scnto
    DW03_bictr_scnto #(width, count_to)
        U1 ( .data(inst_data), .up_dn(inst_up_dn), .load(inst_load),
            .cen(inst_cen), .clk(inst_clk), .reset(inst_reset),
            .count(count_inst), .tercnt(tercnt_inst) );

endmodule
```

Revision History

For notes about this release, see the [DesignWare Building Block IP Release Notes](#).

For lists of both known and fixed issues for this component, refer to the [STAR report](#).

For a version of this datasheet with visible change bars, click [here](#).

Date	Release	Updates
March 2019	DWBB_201903.0	<ul style="list-style-type: none">■ Clarified license requirements in Table 1-3 on page 2■ Added “Enabling minPower” on page 5
January 2019	DWBB_201806.5	<ul style="list-style-type: none">■ Updated example in “HDL Usage Through Component Instantiation - VHDL” on page 6■ Added this Revision History table and the document links on this page

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